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A PRACTICAL QUESTION AND ANSWER GUIDE ON VDTs (VIDEO
DISPLAY TERMINALS) F. (U) AIR FORCE OCCUPATIONAL AND
ENVIRONMENTAL HEALTH LAB BROOKS AF. B M OLSON

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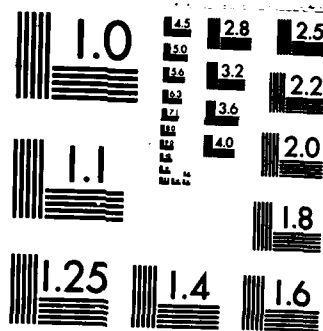
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A PRACTICAL QUESTION AND ANSWER
GUIDE ON VDTs FOR BEES
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Commander



DEPARTMENT OF THE AIR FORCE
USAF OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (AFSC)
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REPLY TO
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7 MAR 1985

SUBJECT USAF OEHL Report 85-059RN111BEJ, A Practical Question and Answer Guide on VDTs
for BEEs

TO All Bioenvironmental Engineers

1. The attached USAF OEHL report was prepared at the request of HQ AFMSC/SGPA and is intended to be a reference guide for the Base Bioenvironmental Engineer in answering questions regarding Video Display Terminals (VDTs).

2. This report is, in effect, an extensive review of both scientific and non-scientific literature that has been published on the subject of VDTs. The report is presented in a question and answer format in an attempt to paraphrase the most commonly asked questions that have been forwarded to USAF OEHL/RZN.

3. If there are any questions about this report or you require information on specific reference material, please contact 1Lt Burl M. Olson at USAF OEHL/RZN (AV 240-3486).

David R. Case

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) The USAF OEHL conducted an extensive literature review of Video Display Terminals (VDTs) and the health problems commonly associated with them. The report is presented in a question and answer format in an attempt to paraphrase the most commonly asked questions about VDTs that have been forwarded to USAF OEHL/RZN.					
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A PRACTICAL QUESTION AND ANSWER
GUIDE ON VDTs FOR BEES


1 Jan 1985

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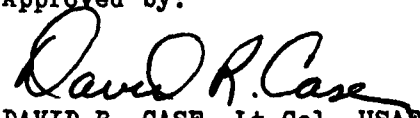

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I. INTRODUCTION

The purpose of this booklet is to assist the Base Bioenvironmental Engineer in answering questions pertaining to the use of Video Display Terminals (VDTs) and the health problems possibly associated with them. This booklet was prepared at the request of HQ AFMSC/SGPA and is, in effect, a summary of an extensive literature review of the subject.* This booklet is presented in a question and answer format in an attempt to paraphrase the most commonly asked questions that have been forwarded to USAF OEHL/RZN. The questions and answers have been divided into several topic areas:

1. Ionizing Radiation;
2. Nonionizing Radiation;
3. Optical Radiation;
4. Ultrasound;
5. Static Electricity;
6. Health Complaints/Ergonomics;
7. Pregnancy.

See DD/473 (Block 18) Originator supplied keywords include:

II. IONIZING RADIATION

Q. DO VDTs GENERATE X-RAYS?

A. Low energy x-rays can be generated by the cathode ray tube (CRT) and the electronic deflection circuits of the VDT.

Q. HOW MUCH X-RAY RADIATION IS THERE?

A. Numerous x-radiation surveys by both independent and governmental agencies on various VDT makes and models have been reported with the findings rarely exceeding background radiation levels. The Code of Federal Regulations (CFR) 21 Part 1020.10 limits the x-ray emission from a VDT to a maximum of 0.5 millirem per hour at 5 centimeters from any point on the external surface of the VDT.

Q. WILL THIS AMOUNT OF RADIATION HURT ME?

A. The U.S. radiation protection guideline for non-occupational radiation exposures, excluding medical use, is 500 millirem per year. A full time VDT operator will receive an annual radiation dose of less than 100 millirem per year, or less than one fifth the acceptable standard for a member of the general public.

*A current list of VDT reference materials is being maintained at USAF OEHL/RZN. (AV 240-3486)

Q. WHERE DO THESE X-RAYS COME FROM?

A. In order to produce images on a CRT, a beam of high energy electrons is accelerated towards a phosphor-coated screen. As the electron beam passes through the screen it excites the phosphors which in turn produce light and thus the visual images on the screen. As the electron beam moves from the cathode and strikes the anode of the CRT a small energy release results and low energy x-rays may be produced. This same phenomenon occurs with television sets which produce images in essentially the same manner.

Q. WHAT IS BEING DONE TO PROTECT ME FROM X-RAYS?

A. Since 1970, CRT manufacturers, together with CRT glass envelope manufacturers, have increased x-ray shielding properties of the glass envelope to assure minimal x-ray emission. The Center for Devices and Radiological Health (CDRH), of the U.S. Food and Drug Administration is the government monitoring agency that ensures compliance with the 21 CFR 1020.10 x-ray emission standard.

III. NONIONIZING RADIATION

Q. AM I BEING EXPOSED TO MICROWAVES?

A. The region of the electromagnetic spectrum that is classified as microwaves is the frequency range of 300 MHz to 300 GHz. VDTs do not normally emit electromagnetic energy in this frequency range. However, VDTs do emit low levels of electromagnetic energy in the radio frequency range of 10 KHz to 150 KHz.

Q. WHAT IS AN ELECTROMAGNETIC ENERGY WAVE?

A. Electromagnetic energy is an electrical wave which propagates outward in free space from a source. It consists of mutually supporting and oscillating electric and magnetic fields which travel at the speed of light and are at right angles to each other and to the direction of travel. Television and radio transmissions are examples of electromagnetic energy sources.

Q. WHAT IS MEANT BY "POWER DENSITY"?

A. The rate at which energy flows through a unit area in space is called the power density of the wave and is usually expressed in power per unit area, e.g., milliwatts per square centimeter. Electromagnetic energy, specifically radio frequency emissions, is quantified in this manner.

Q. WHAT ARE THE POWER DENSITY LEVELS AROUND MY VDT?

A. The primary source of radio frequency emissions from a VDT is the CRT face. A typical VDT power density at the screen face is 0.1 mW/cm². This power density level drops to less than 0.01 mW/cm² at the normal VDT operator's position.

Q. ARE THESE LEVELS SAFE?

A. The most stringent guidelines for non-occupational RF radiation exposure have been proposed by the U.S. Environmental Protection Agency (EPA). The EPA safe continuous exposure guideline for frequencies between 10 KHz and 3 MHz is 10 mW/cm². The levels coming off a VDT are far below present and proposed safe continuous exposure guidelines and biological effects are very unlikely.

Q. HOW COME MY VDT EMITS RADIO FREQUENCY ENERGY?

A. In order to produce visual images on a VDT screen, a series of electrical signals from the flyback transformer (Figure 1) to the deflection drive circuits must be pulsed on and off. The turning on and off of the high voltage at a rate of approximately 20,000 times a second creates the radio frequency fields around the VDT.

Q. WHAT ABOUT LONG-TERM EXPOSURE TO LOW-LEVEL ELECTROMAGNETIC FIELDS?

A. Chronic exposure to weak electromagnetic (EM) fields has been the subject of a great deal of research. The research has been concerned with both continuous wave (CW) and pulsed wave chronic effects. Research in the area of CW chronic exposure effects has not revealed any significant biological consequences to long-term, low-level EM energy. Research in pulsed wave chronic exposure effects has centered mostly around the possibility that low-level EM energy at specific frequencies can cause specific biological effects. The results of these experiments are very inconclusive. Continued research in both CW and pulsed wave low-level EM energy chronic exposure effects is indicated and ongoing.

IV. OPTICAL RADIATION

Q. DO THE CHARACTERS ON THE SCREEN EMIT ANY KIND OF RADIATION?

A. Optical radiation is produced during electron beam excitation of the phosphors to produce a screen image. Near ultraviolet (300-400 nm), visible (400-700 nm) and near infrared (700-820 nm) radiation can be emitted from the screen face.

Q. IS THERE ENOUGH OPTICAL RADIATION TO HURT ME?

A. Optical radiation emissions from VDTs are considerably lower than the standards and/or guidelines presently in effect. No eye or skin effects have been observed at optical radiation levels as low as those measured from VDTs.

CATHODE-RAY TUBE and POWER CIRCUITS

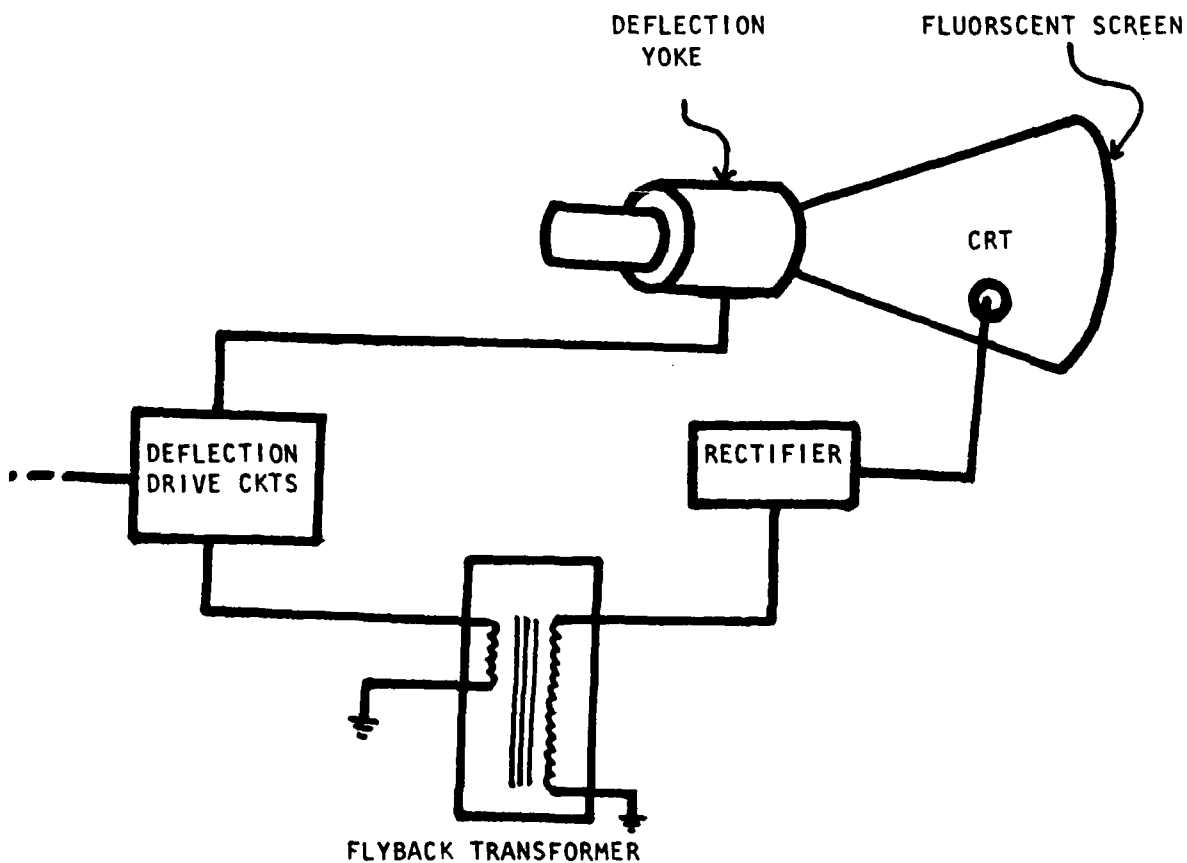


FIGURE 1

V. ULTRASOUND

Q. WHAT IS THE SOURCE OF THE HIGH PITCH NOISE?

A. The source of ultrasound within a VDT is the mechanical response of the flyback transformer core to the alternating voltage produced by the horizontal sweep oscillator. The frequency of this sound energy is approximately 20 kHz.

Q. CAN THIS ULTRASOUND HURT MY HEARING?

A. The present standard for ultrasound exposure in the U.S. is 80 dB. An average reading for a VDT is 55 dB which is well below the energy associated with biological effects and is most often a lower sound level than background noise levels considered to be acceptable in the office environment.

Q. CAN ANYTHING BE DONE TO STOP THIS NOISE?

A. The frequency of this sound level is usually beyond the normal adult hearing range. For those individuals who can hear in this range, it is possible to add soundproofing insulation around the flyback transformer to reduce the annoyance.

VI. STATIC ELECTRICITY

Q. WHY IS THERE STATIC ELECTRICITY AROUND MY VDT?

A. The relatively high voltages (15,000 to 20,000 volts) that are used at the VDT flyback transformer can produce a build-up of electrically charged air ions around the VDT and the operator.

Q. DOES THIS STATIC ELECTRICITY CAUSE FACIAL RASHES?

A. The Scandinavian theory that the exchange of ions between the VDT and the operator causes irritation of the hair follicles or the attraction of air pollutants to the operator's face is only that, a theory. No definite conclusions linking facial rashes and static electricity have been established. Facial rashes in VDT operators should be referred to a qualified physician for diagnosis and treatment.

Q. WHAT CAN BE DONE TO GET RID OF THE STATIC ELECTRICITY?

A. Electrostatic fields occur most often in the workplace when the relative humidity is low and fiber carpets are present. The use of antistatic sprays that are commercially available has met with limited success as a temporary measure. Increasing the relative humidity or even the use of a conductive pad under the VDT station will reduce the electrostatic field.

VII. HEALTH COMPLAINTS/ERGONOMICS

Q. WHY DO MY EYES BURN AND FEEL TIRED?

A. Eyestrain (eye fatigue), headaches and generalized fatigue seem to be directly related to workplace, lighting, and work station design. Glare and reflections from the VDT screen along with unbalanced brightness between the VDT screen, the keyboard, and hard copy area can cause excessive eye muscle action (pupillary constriction/dilation, ciliary body) and thus eyestrain.

Q. WHAT CAN BE DONE TO HELP?

A. The elimination or reduction of glare and reflections can be approached in two ways.

The first method is to eliminate the source of the glare or reflection. The two primary sources of reflection and glare are sunlight and overhead lighting. Sunlight reflection and glare can be reduced by the use of drapes, blinds, shades, screens and/or tinting over windows. Overhead lighting glare and reflections can be controlled by recessing and/or baffling the general lighting fixtures to create an indirect diffuse lighting system.

The second method for reducing reflection and glare is to protect the VDT screen itself. Screen hoods and antiglare filters are available for most VDT makes and models, but one equally effective control is to properly position the VDT screen away from sources of glare and reflections.

The problem of unbalanced brightness between task areas will be reduced once the glare and reflection problems are corrected. In addition, the use of an upright copy holder in conjunction with a VDT display contrast that can be adjusted will help to eliminate eyestrain.

Q. WHY DO I SEE PINK LETTERS ON THE HARD COPY AFTER I'VE BEEN LOOKING AT THE VDT SCREEN FOR A WHILE?

A. This is a well known phenomenon known as the "McCollough effect." If you have green letters on your VDT screen, the type on your hard copy may seem to have a pink tint. If you have amber letters on your screen, the type on your hard copy may seem blue-green. The McCollough effect is a physiological effect that is believed to arise from the adaptation of the eyes to specific combinations of color and form. The effect is considered harmless and is temporary.

Q. SHOULD I BE GETTING EYE EXAMS PERIODICALLY?

A. No special occupational physicals have been recommended or suggested for VDT operators. Symptoms of eyestrain and fatigue are temporary and are not usually associated with decreases in visual acuity.

Q. I GET BACKACHES, SHOULD MY CHAIR BE ADJUSTABLE?

A. Musculoskeletal fatigue, discomfort and pain could have root in a number of work station design factors. The design of the chair, the height of the keyboard, the viewing angle and distance, and the task area locations are all factors that can be attributed to awkward working postures leading to backache, fatigue and other musculoskeletal problems.

Q. WHAT IS THE RECOMMENDED WORK STATION DESIGN?

A. Every operator is physically unique and thus requires a specific work station design. Three important points of VDT and operator interface are the hand to the keyboard, the eyes to the screen and copy materials, and the body to the chair. In general, the keyboard should be at a height so that the forearm is in a horizontal position, the angle from the eyes to the screen should be between 10 and 20 degrees at a distance of 40 to 50 cm, the upright copy holder should be positioned close to the VDT to minimize repetitive motions, and the chair should have a full backrest, with adjustable height that allows freedom of motion for arms and shoulders (Figure 2). The best work station design is the one that the operator feels most comfortable with.

Q. I HEAR A LOT OF TALK ABOUT STRESS CAUSING HEALTH PROBLEMS, IS THAT TRUE?

A. Physical or mental stress has long been recognized as contributing factors in health complaints and/or recovery. The causes of stress in a VDT related job are not necessarily associated with the VDT itself but are more often a result of the physical and mental demands of the job. The most common complaints are:

1. heavy work load
2. long hours
3. lack of job security
4. monotonous/repetitive work (no variety)
5. under utilization of skills
6. machine (rapid) pacing of work
7. little or no control over work
8. being treated like a machine

RECOMMENDED WORK STATION DESIGN/DIMENSIONS

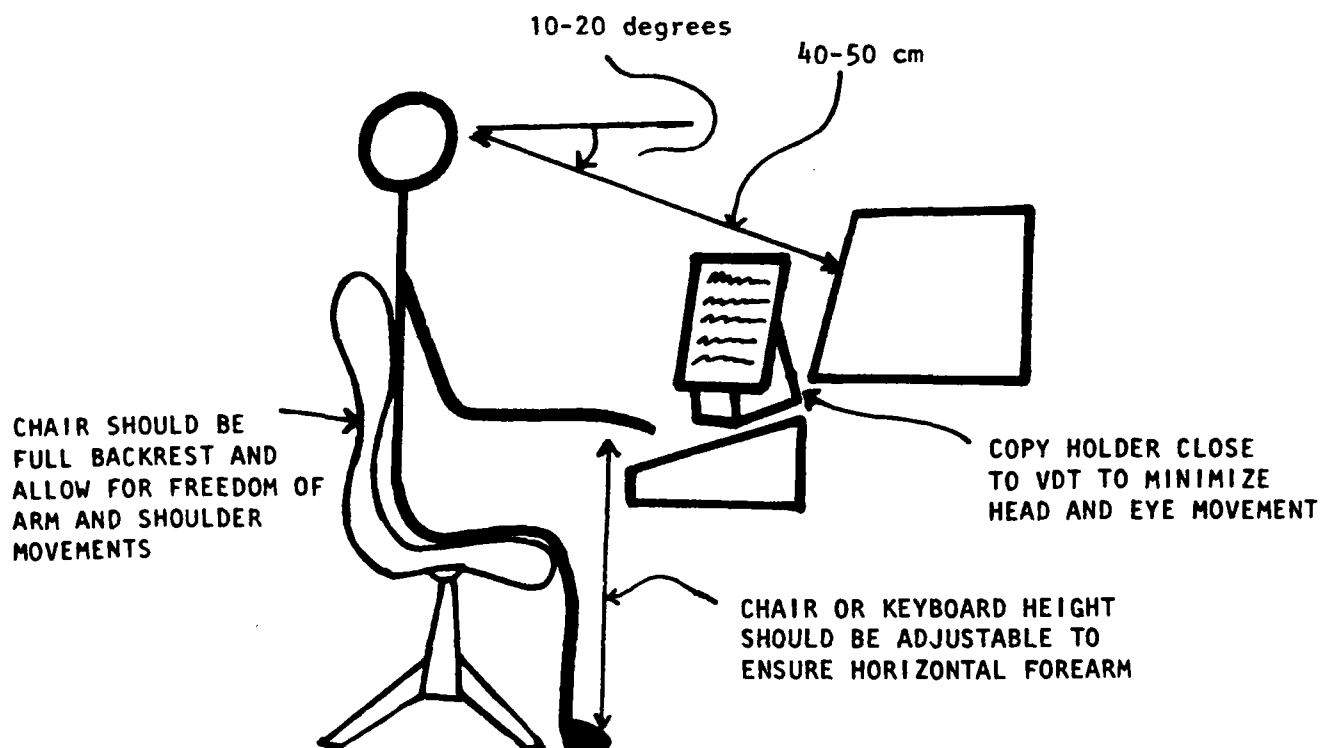


FIGURE 2

VIII. PREGNANCY

Q. I'M PREGNANT, IS WORKING AT A VDT GOING TO AFFECT MY BABY?

A. No causal relationship between VDT use and hazards to the unborn has been established.

Q. WHAT ABOUT ALL THESE CLUSTERS OF PREGNANCY PROBLEMS AND VDTs?

A. As of 1 Dec 1984, eight clusters of problem pregnancies among VDT users have been reported and investigated. The results have been reported by the Food and Drug Administration's Center for Devices and Radiological Health (CDRH). The report stated: "the reported clusters of problem pregnancies among VDT users would be expected (statistically) from chance alone, it is highly unlikely that these clusters have been caused by low-level radiation emissions from the VDTs."

Q. WILL I BE ASSIGNED TO AN ALTERNATE JOB DURING MY PREGNANCY?

A. Current Air Force Policy states that there is no basis for automatic work reassignment of pregnant VDT operators. However, if you and your physician believe that your work or job is creating a potential problem with your pregnancy you may ask to be reassigned to an alternate position during the pregnancy.

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